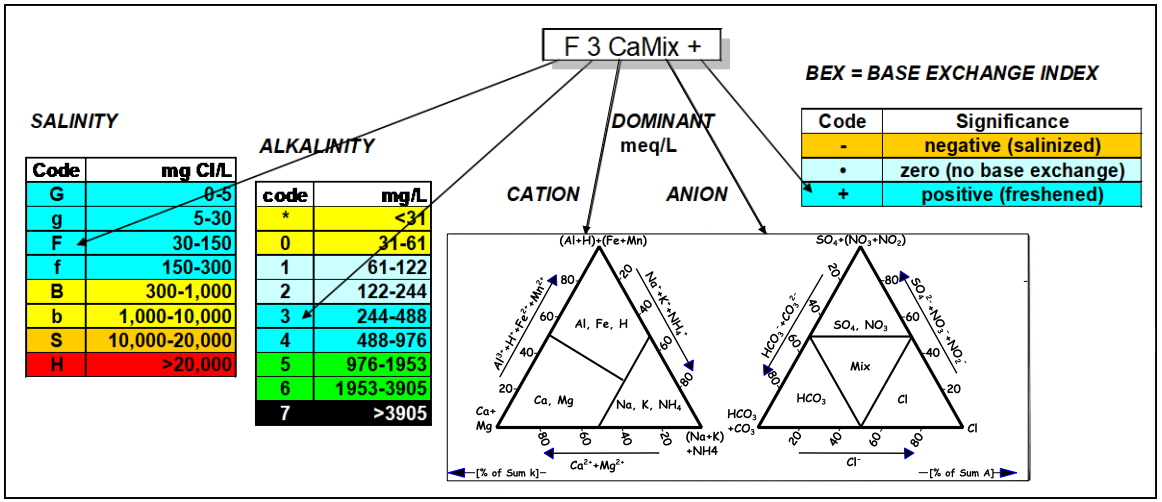
Assignment 4: determine watertype, redoxlevel and POLIN

mg/L												
		Major cations					Major anions					
		Na	K	Mg	Ca	NH4	Cl	HCO3	SO4	NO3	Fe(2)	Mn(2)
Example #	pH											
1	5.52	4.2	2.2	4.2	4	0.06	5	4	31	4.4	0.07	0.08
2	6.03	8.9	0.9	0.7	2	0.06	15	5	3	1.2	0.04	0.001
3	6.58	5.8	0.7	1	4	0.08	8	13	6	0	2.6	0.03
4	6.38	6.4	0.8	0.7	5	0.04	9	24	6	0	0.67	0.04
5	7.13	17	27	9.4	140	0.63	19	480	80	0	14.8	0.62
6	7.53	19	3.2	11.6	133	0.06	34	229	160	35	0.02	0.52
7	7.74	21	2.4	11.2	94	0.07	33	146	81	110	0.02	0.2
8	7.68	15	0.7	5	80	0.11	30	191	58	0	2.1	0.13
9	7.48	54	5	8.7	98	0.04	80	245	94	0.2	0.07	0.44
10	8.16	30	1.8	11.1	73	0.01	48	81	64	110	0.03	0
	Molar weights											
		Na	K	Mg	Ca	NH4	Cl	HCO3	SO4	NO3	Fe(2)	Mn(2)
		22.989	39.098	24.305	40.078	18.039	35.453	61.016	96.062	62.004	55.847	54.931

Watertype



Manually or:

=CONCATENATE(

IF(J31>564.17;"H";IF(J31>282.087;"S";IF(J31>28.21;"b";IF(J31>8.463;"B";IF(J31>4.231;"f";IF(J31>0.846;"F";IF(J31>0.141;"g";"G")))))));

IF(K31<=0.5;"*";IF(K31<=1;"0";IF(K31>512;"9";INT(LOG(K31)/LOG(2)+1))));"-";

IF((E31+F31+I31)>(G31*2+H31*2+10^(-C31)+N31*2+O31*2);IF(I31>(E31+F31);"NH4";
IF(E31>F31;"Na";"K"));
IF((H31*2+G31*2)>(10^(-C31)+N31*2+O31*2);IF(H31>G31;"Ca";"Mg");
IF((10^(-C31))>=(N31*2+O31*2);"";
IF(N31>O31;"Fe";"Mn"))));

IF(J31>(L31*2+M31+K31);"Cl";
IF((K31)>(J31+L31*2+M31);IF(K31>0;"HCO3";"CO3");
IF((L31*2+M31)>(J31+K31);IF((L31*2)>M31;"SO4";"NO3");"MIX")));

IF(ABS((E31+F31+2*G31)-1.0716*J31)<(0.5+0.02*J31);"";
IF(((E31+F31+2*G31)-1.0716*J31)<-0.5;"-";"+")))

Redox level

Level	Environment	Criteria			
		NO_3^-	Mn^{2+}	Fe^{2+}	SO_4^{2-}
0-2	Suboxic	>=1	<0.5	<0.25	>=0.9$(SO_4)_o$
3	Transition	<1	>=0.5	<0.25	>=0.9$(SO_4)_o$
4	Sulphate-stable	<1	>=0.5	>=0.25	>=0.9$(SO_4)_o$
5-6	Deep anoxic	<1	>=0.5	>=0.25	(0-0.5)*$(SO_4)_o$

Manually or:

	R	S	T		
	Redox level (apply Table 3.5)				
	Q: Is sample concentration above threshold?				
	NO3	Mn	Fe	(SO4)	Redox level
	1	**0.5**	**0.25**		
Example #					
1	yes				0-2
2	yes				0-2
3			yes		4-6
4			yes		4-6
5		yes	yes		4-6
6	yes	yes			conflict
7	yes				0-2
8			yes		4-6
9					all values too low
10	yes				0-2

```
=IF(R10="yes";
    IF(S10="";
      IF(T10="";"0-2";"conflict");"conflict");
       IF(OR(S10="yes";T10="yes");"4-6";"all values too low"))
```

POLIN (for A and B only)

Manually or:

Pollution type	Symbol	Formula
Measure of acidification or eutriphication	A	$1.333 * \lvert pH - 7 \rvert$
Measure of application of fertilizer or manure or infiltration of waste water	B	$\frac{\ln\{10 * [\frac{NO_3}{62} + SO_4^c]\}}{\ln 2}$ Please note: $if\ \{\ldots\} < 1, then\ B = 0$ $SO_4^c = 0.67 * (\frac{SO_4}{96} - \frac{0.0232 * Cl}{35.453})$ Please note: $if\ SO_4^c < 0, then\ in\ B: SO_4^c = 0$

	A	SO4c	{…}	B	A+B	PI
Example #						
1	1.9728	0.2142	2.8513	1.5116	3.5	2.1
2	1.293	0.0144	0.3372	0	1.3	0.8
3	0.5599	0.0384	0.3837	0	0.6	0.3
4	0.8265	0.0379	0.3793	0	0.8	0.5
5	0.1733	0.55	5.5	2.4594	2.6	1.6
6	0.7065	1.1018	16.663	4.0586	4.8	2.9
7	0.9864	0.5508	23.25	4.5392	5.5	3.3
8	0.9064	0.3916	3.9164	1.9695	2.9	1.7
9	0.6398	0.621	6.2419	2.642	3.3	2.0
10	1.5463	0.4256	21.998	4.4593	6.0	3.6

Watertypes

Example #	W-TYPE	Redox level	PI
1	g*-MgSO4	0-2	2.1
2	g*-NaCl	0-2	0.8
3	g*-CaMIX	4-6	0.3
4	g*-CaHCO3	4-6	0.5
5	g3-CaHCO3+	4-6	1.6
6	F2-CaMIX+	conflict	2.9
7	F2-CaNO3+	0-2	3.3
8	F2-CaHCO3	4-6	1.7
9	F3-CaMIX+	all values too low	2.0
10	F1-CaNO3+	0-2	3.6